Big Thunder Mountain Roller Coaster Mishap

Disneyland, Sept 2003

Leadership ViTS Meeting
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Bryan O'Connor
Chief, Safety and Mission Assurance

Presentation Material

Courtesy of CAL OSHA

and

Emmett Peter

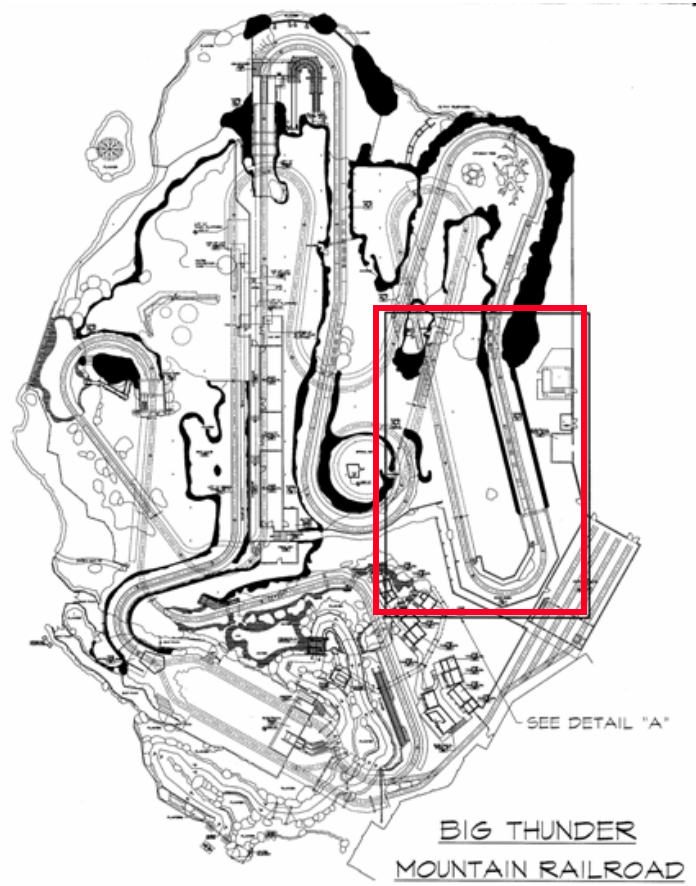
Director, Global Safety and Assurance

Walt Disney Parks and Resorts (Chairman of Disney Investigation Team)

Disney's Mishap Investigation Team

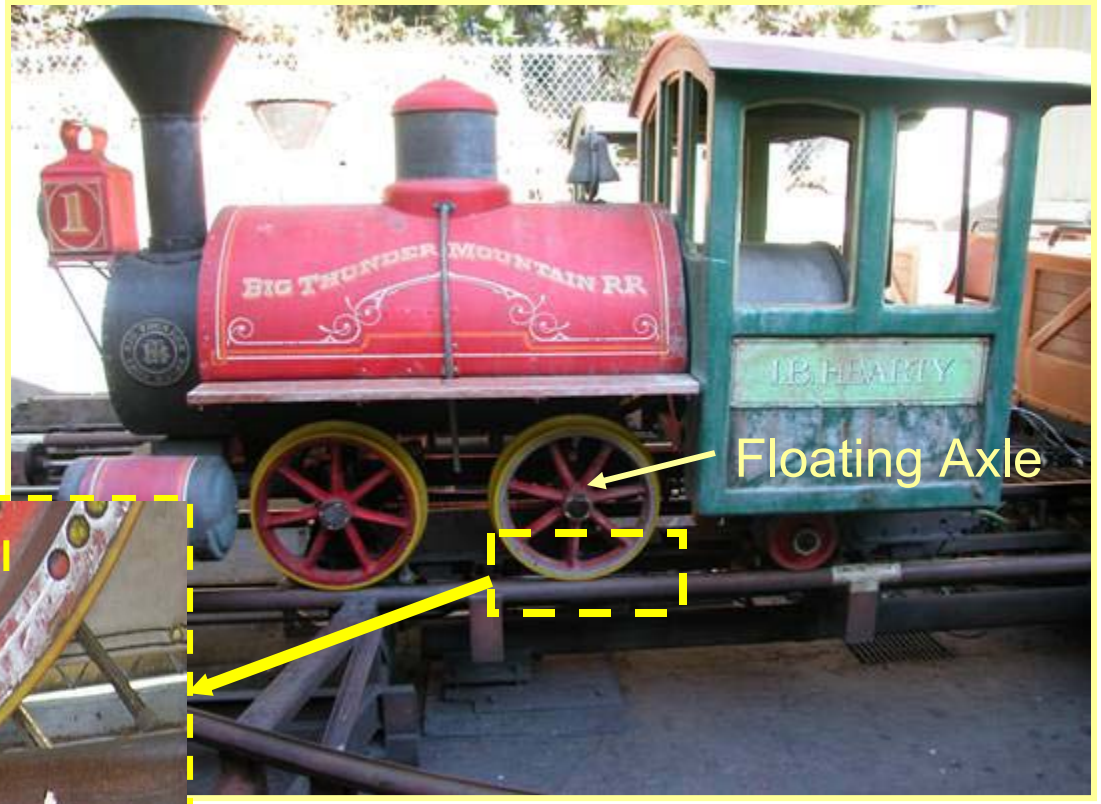
Big Thunder Mountain Accident

- On September 5, 2003 at approximately 11:18 AM PDT, 1 patron killed and 10 others injured in train ride derailment
- Undesired Event – On Train #2, the first passenger Car behind the locomotive rode underneath the de-railed locomotive in safety brake zone tunnel
- Proximate cause: incomplete installation of the locomotive's left side floating axle upstop guide wheel during routine corrective maintenance.
- Various errors prevented detection of the incomplete installation.



Big Thunder Mountain Accident: The Hardware

Train # 1 (properly configured)



Safety Wire (properly applied)

Big Thunder Mountain Accident-What Happened

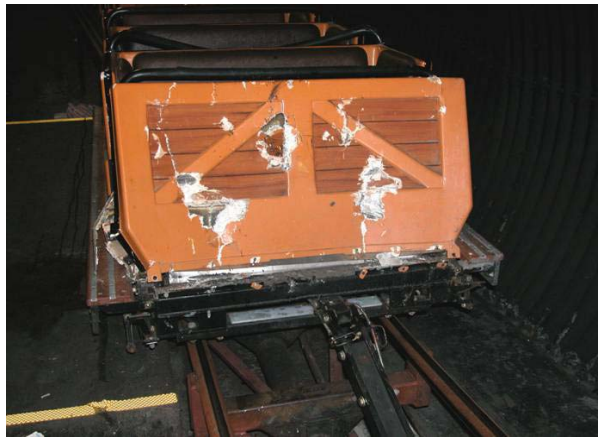
Pre Accident Phase

- Corrective maintenance performed Tuesday, Sept 2 to replace worn upstop guide wheel on Loco #2
- The operation to replace the wheel was left incomplete: bolts installed, but no torque or safety wire
- Train not used until Friday Sept 5; apparently not re-inspected due to unused status
- Train #2 was added at 10:30 Pacific Daylight Time (PDT) Completed 12 test laps w/o passengers
- Both bolts and then upstop itself fell off during last run
- Some reports of noise from train – No action taken
- Operations loaded and dispatched train with passengers

Big Thunder Mountain Accident-What Happened

Accident Phase

- Operators started operational run without left wheel upstop
- Without upstop, floating axle was not constrained. It shifted to left at approach to brake zone 1 which is located in a tunnel
- Wheel began to contact ties underneath Loco, causing Loco to stop suddenly, nose low
- Sudden stop forced passenger car #1 underneath Loco, broke tow bar, wedged loco between car #1 and top of tunnel
- "Pileup" substantially damaged first row seats, causing fatal injuries to a 22 year old passenger (blunt force trauma to chest). Other passengers injuries consistent with sudden stop



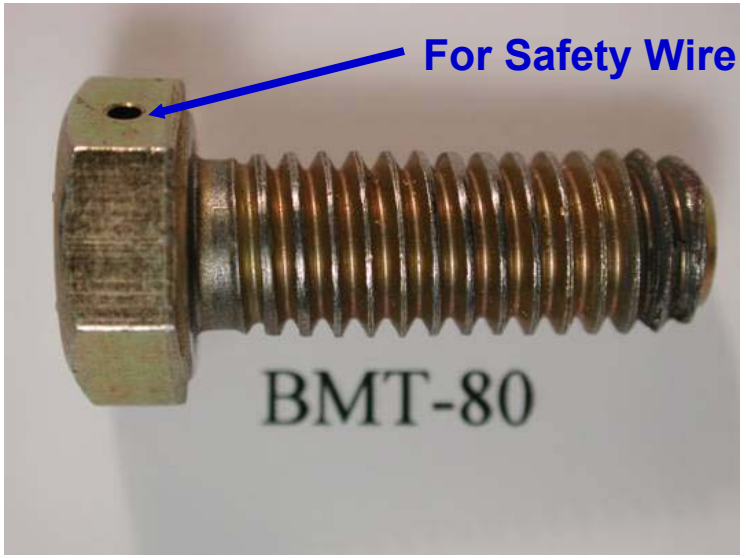
Contributing and Cause Factors

Proximate Causes:

- **Human Error. Failure to torque and install safety wire to bolts on upstop guide wheel assembly per Disney procedure**

- **Supervision/procedures/training:**
  - **Failure to perform inspection after maintenance in violation of Disney policy**

  - **Failure of operations test team to react properly to "unusual noise" heard during test runs: lack of clear test pass/fail criteria and poor tester training**



Contributing Cause Factors

Complacency

- Discounting of previous similar close calls (slow moving vehicle, nobody hurt)
- Operations crews de-sensitized to unusual noise?
- Operators pulled “not ready” tag off “hanger queen” train without inspection

Lack of proper process discipline

- Tagging of "not ready" vehicles was a procedure but it was not seen as mandatory and so it was not always followed
- Operators allowed to sign for work done by others

Results of Investigation Findings and Recommendations

- Major changes in process. (Now, unambiguous, auditable processes in place).
- Second set of eyes for critical maintenance activities
- Use of technology (electronic checklists)
- Uniform mandatory approach to tagging of ride vehicles
- Workers now sign for their own work, and only their own work

Lessons Learned for NASA

- People make mistakes….engineering, operations and assurance processes must anticipate, detect and correct those that can hurt us
- Be alert and curious: our defenses may not be perfect – They may not detect critical errors that can cause loss of life or mission
  - Test
  - Inspection
  - Reviews
  - Anomalies/problems/out of family results
  - Close calls and other lessons learned

None of these work without good communications, including unambiguous procedures. Look for warning signs that these defenses are failing us

- Poorly written or conflicting procedures are not an excuse to back off good practice: if they are ambiguous, fix them…and when we change them, test them with real people in realistic environments
- Discipline is key: if procedures are mandatory, perform them as written…if we need to deviate, use a disciplined process with the right people in the room (including someone who knows why the procedure says what it does).

THE END

California Office of Safety and Health Reference:
http://www.mpimages.net/dlr/compressed/Disneyland/Frontierland/ThunderAccident/thundermountainaccidentreport.pdf